



Cells

Topic 2



What are cells?

- Define cells.
- How big is a cell?

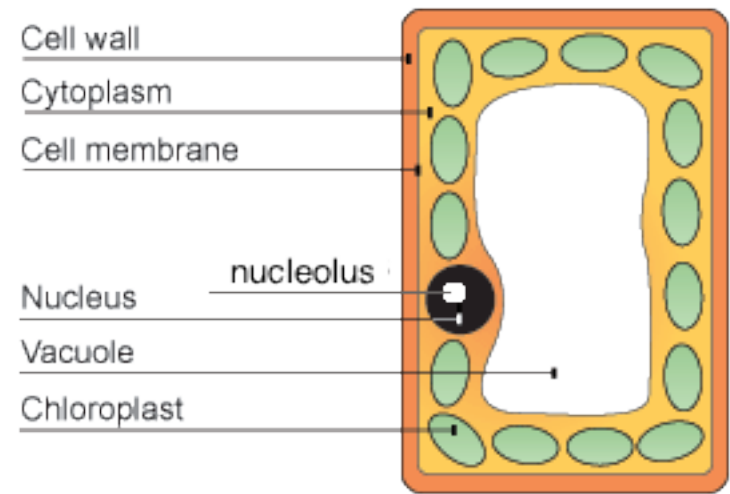
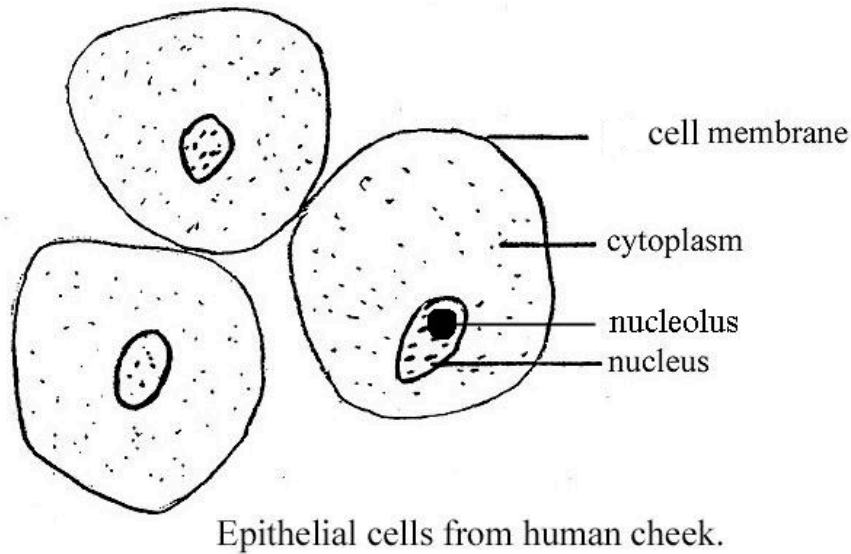
What are cells?

- Cells are the small building block that make up all living organisms
- E.g: bacteria made from one cell
- How many cells are in your body?

What are cells?

- Cells are the small building block that make up all living organisms
- E.g: bacteria made from one cell
- How many cells are in your body? $10 - 50 \times 10^{12}$
- Any differences between plant and animal cells? – draw what you remember of each kind

Animal cell VS plant cell



- What are the similarities and differences?

Animal VS plant cells

feature	Plant cell	Animal cells
Cell wall		
shape		
chloroplasts		
vacuole		
Nucleus		

Animal VS plant cells

feature	Plant cell	Animal cells
Cell wall	present	absent
shape	Shape determined by cell wall – spherical box shaped cylindrical	Vary since no cell wall
chloroplasts	In most cells	absent
vacuole	Large permanent and contain cell sap	Small – no cell sap
Nucleus	Present (on side next to cell wall)	Present (anywhere)

Functions of cell structures

Cell structure	Function
Cell membrane (guard)	
Nucleus (big boss)	
Cytoplasm (roads)	
chloroplast	
Cell wall (fence)	
Sap vacuole	

Functions of cell structures

Cell structure	Function
Cell membrane (guard)	<ul style="list-style-type: none">• Barrier between cell and surround• Keeps cell content inside• Allows and controls substances in/out• Partially permeable
Nucleus (big boss)	<ul style="list-style-type: none">• Controls cell activity/ development
Cytoplasm (roads)	<ul style="list-style-type: none">• Place for chemical reactions (e.g. respiration; making proteins)
chloroplast	<ul style="list-style-type: none">• Photosynthesis• Stores starch
Cell wall (fence)	<ul style="list-style-type: none">• Stops cell bursting• Gives cell shape• Allows substances in/out• FULLY permeable
Sap vacuole	<ul style="list-style-type: none">• Full of water to maintain shape and firmness of cell• Stores salts and sugar

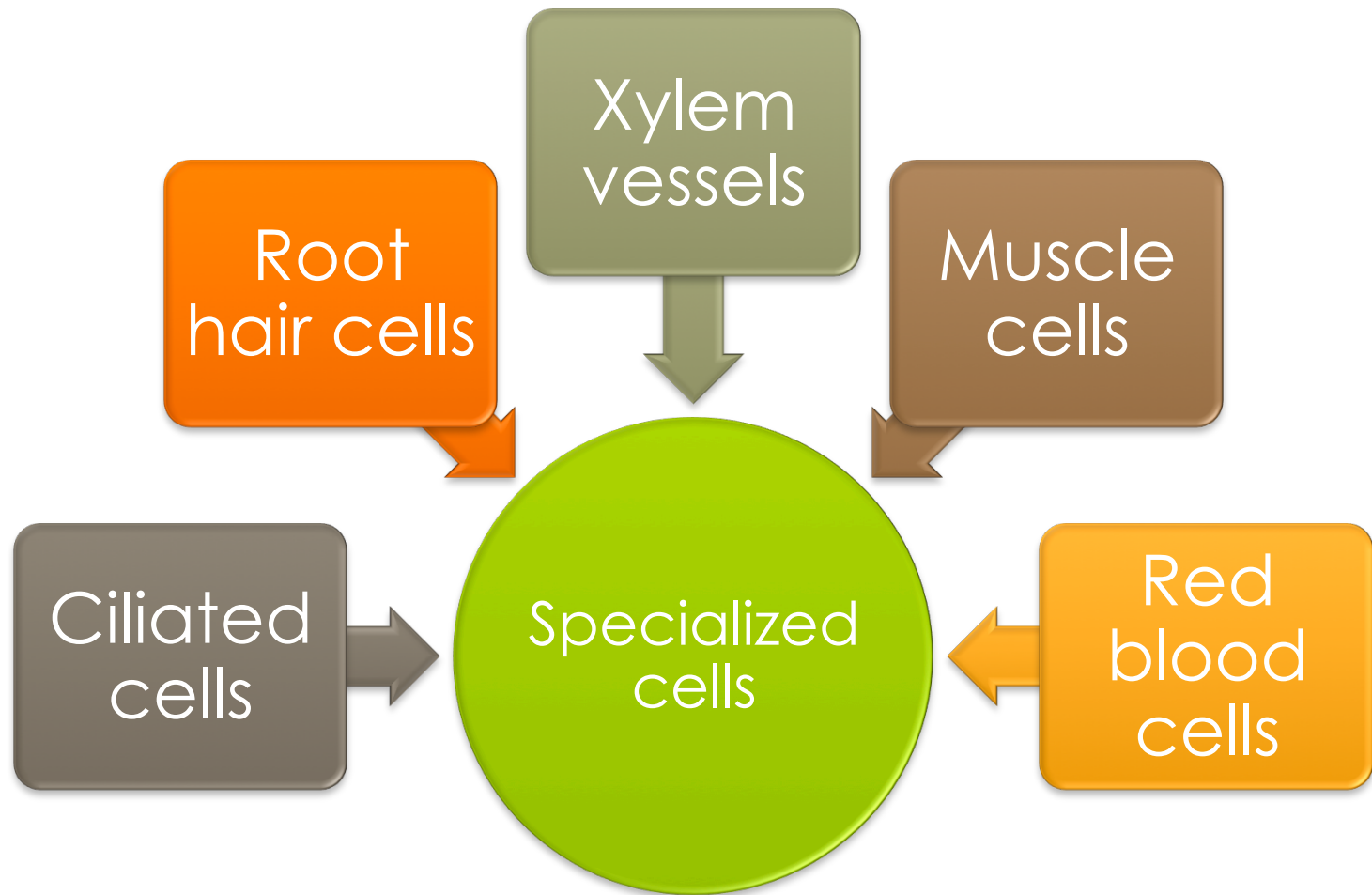
homework

- Answer questions 1 and 2 on page 19.
- Answer questions 1, 2 and 5 on page 24.

Different types of cells

- Discussion: why do you think we have different types of cells? Why aren't all cells the same?
- Write one reason why you think cells need to be different on the strip of paper provided

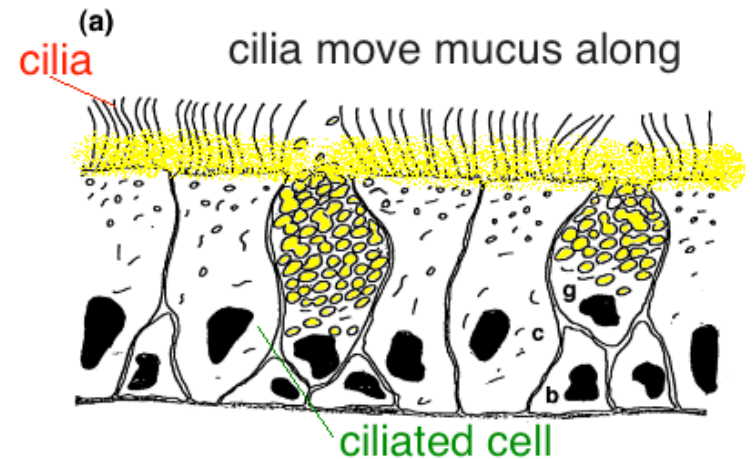
Specialized cells



Specialized cells

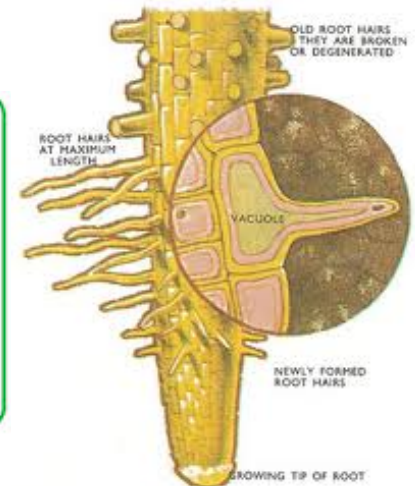
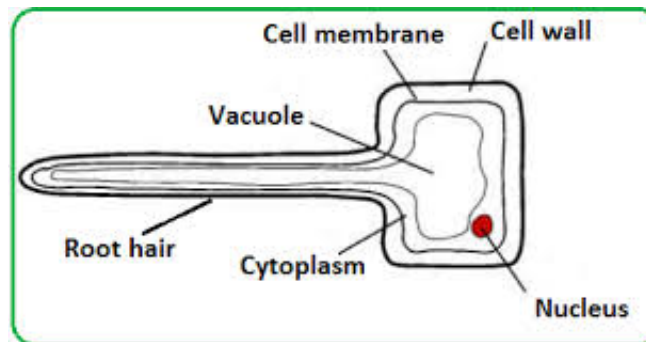
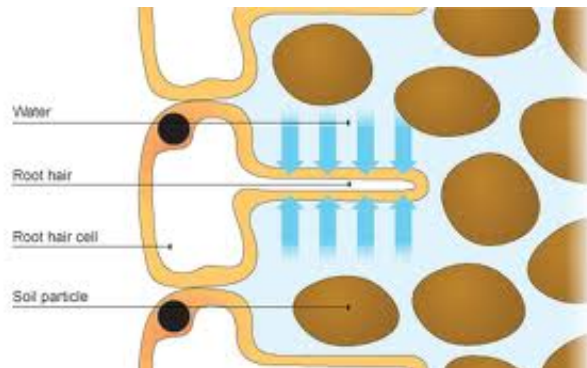
- Ciliated cells:

- have cilia on their surface
- Found in air passage in lungs
- Cilia create current to mucus (mucus traps dust and pathogens)



- Root hair cells:

- Long surface area to absorb more water and ions from soil



Specialized cells

- Xylem vessels: cylindrical (pipes) & empty
 - Cell wall + waterproof material
 - Allow water transfer from root to rest of plant
 - Give plant support
- Muscle cells
 - Made from fibre – can contract
 - Attached to skeleton to move bones at joints
 - Also found in gut and heart

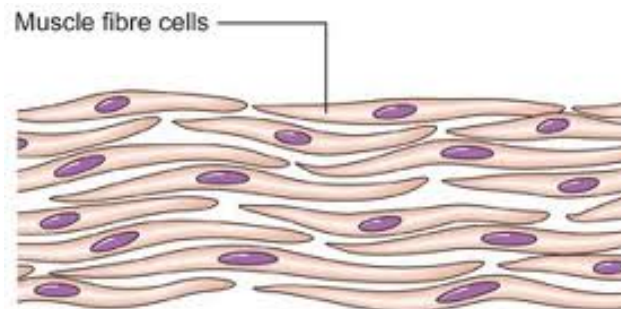
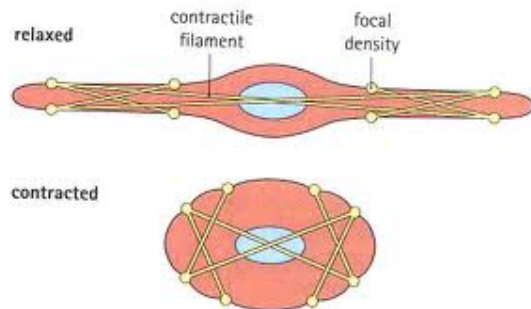
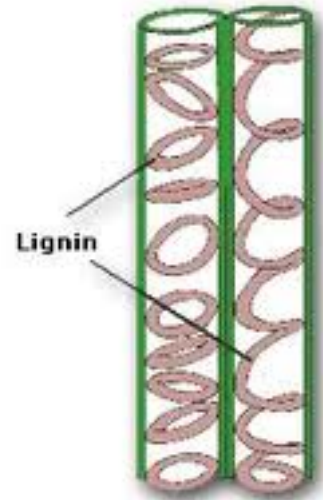
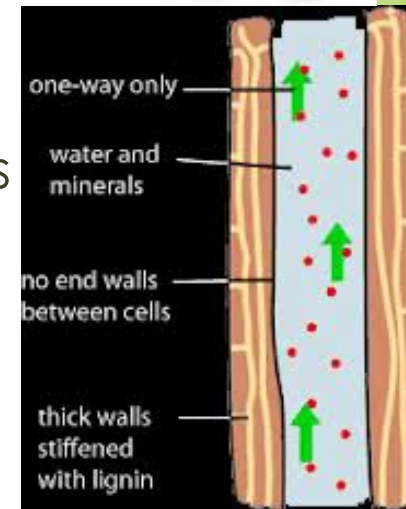


Diagram of muscle cells
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Specialized cells

- Red blood cells
 - Protein: haemoglobin – carry oxygen
 - Disc shaped – large surface area to absorb oxygen



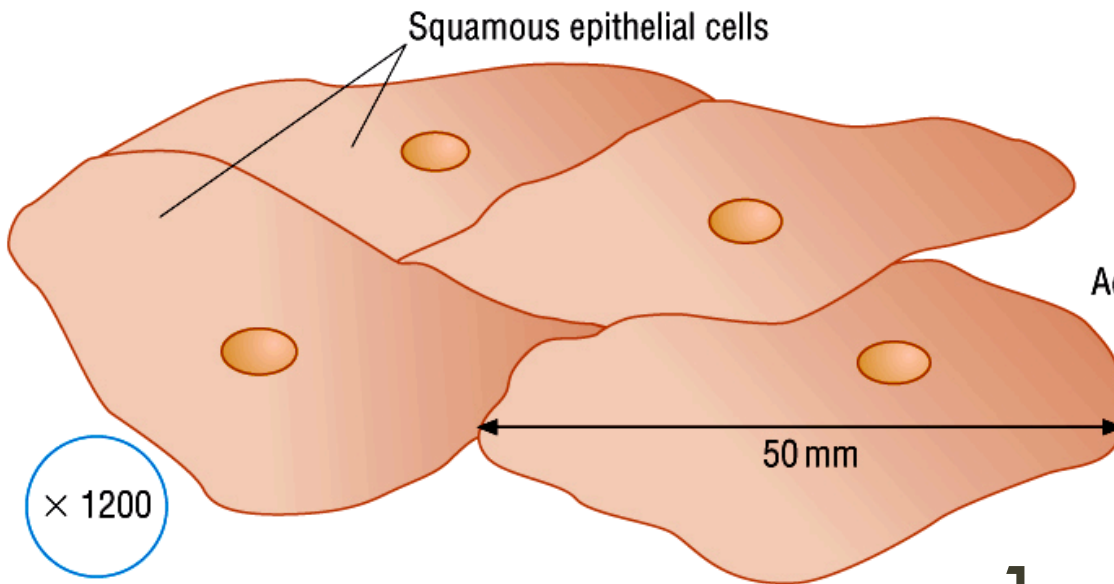
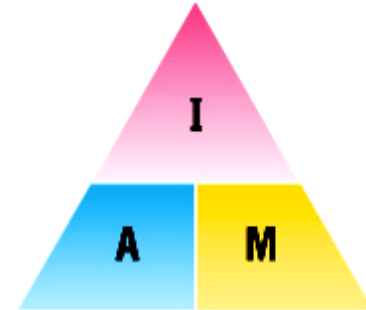
Size of cell

- Measure length → image size (mm)
- Formula:

$$\text{actual size} = \frac{\text{image size}}{\text{magnification}}$$



Size of cell



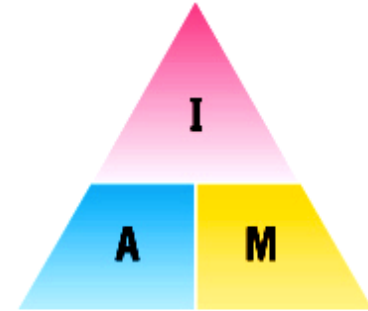
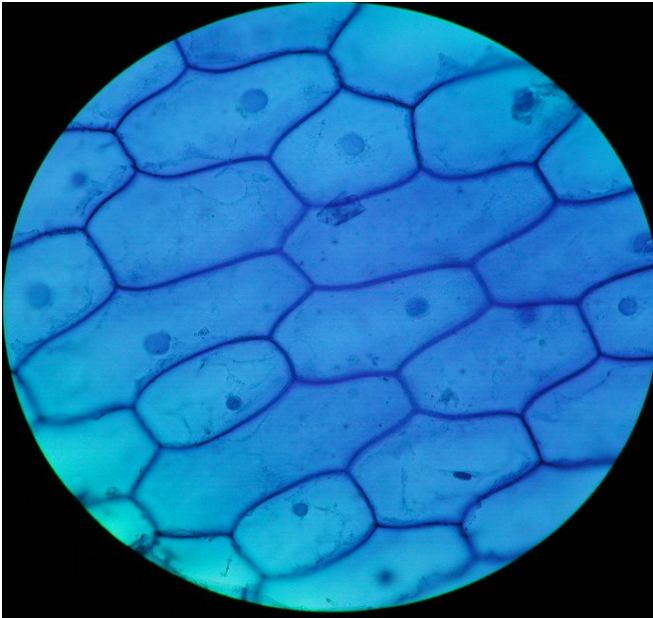
(I) Image size = 50 mm
(M) Magnification = 1200

$$\text{Actual size} = \frac{I}{M} = \frac{50}{1200} = 0.0416 \text{ mm} \\ = 41.6 \mu\text{m}$$

$$1 \text{ mm} = 1000 \mu\text{m}$$

Size of cell

- Calculate the actual size of these cells that were magnified by x250



$$1\text{ mm} = 1000\mu\text{m}$$

Levels of organization

- Do you remember what they are?

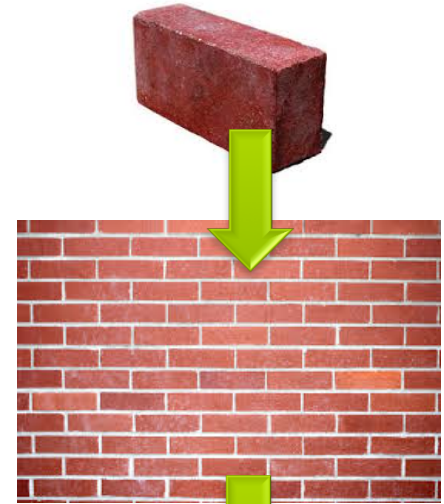
Levels of organization

- How do you build a brick house?



Levels of organization

- How do you build a brick house?



Levels of organization

cells

- Building blocks

tissue

- Same type of cells grouped

organ

- Group of different tissues working together to perform a specific task

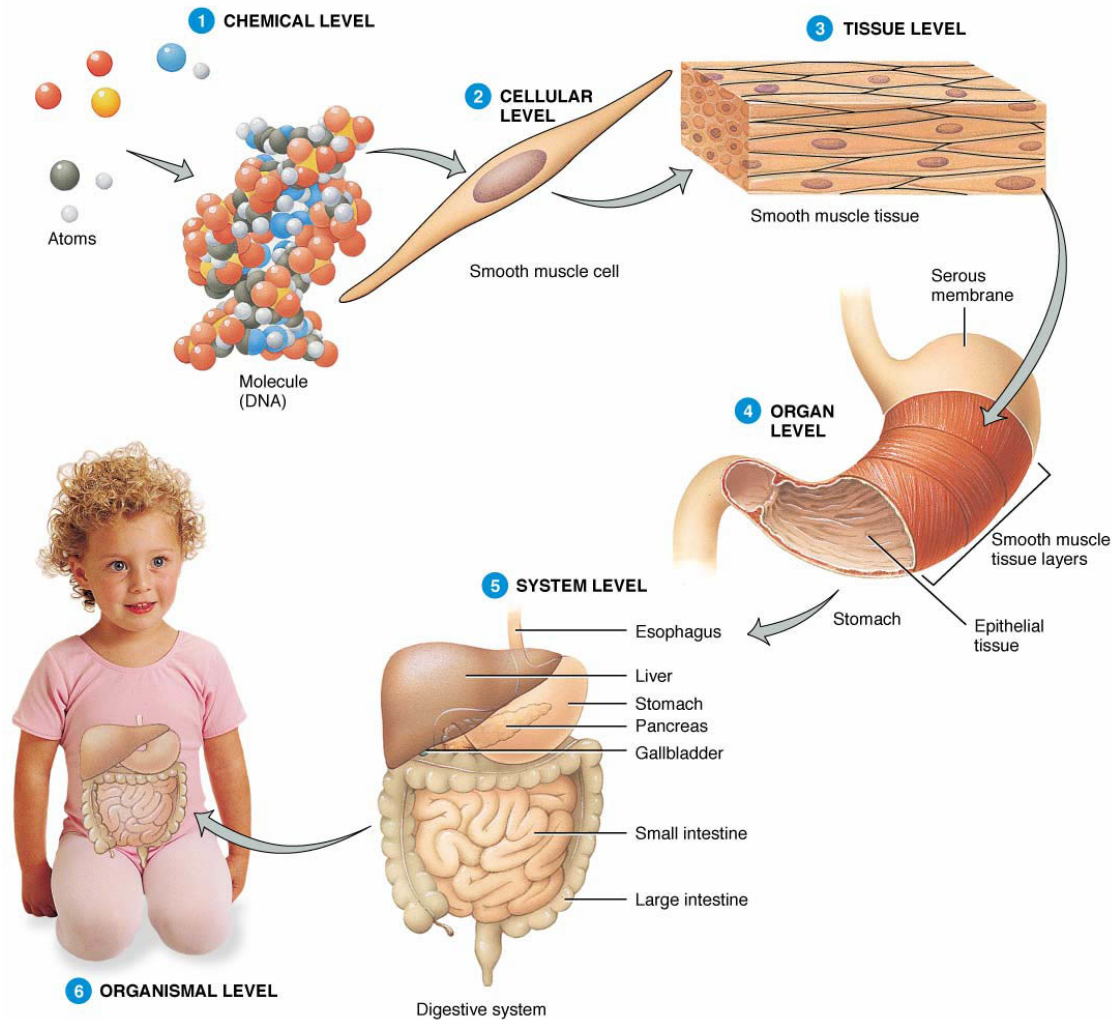
Organ System

- Group of organs with related function working together to perform body task

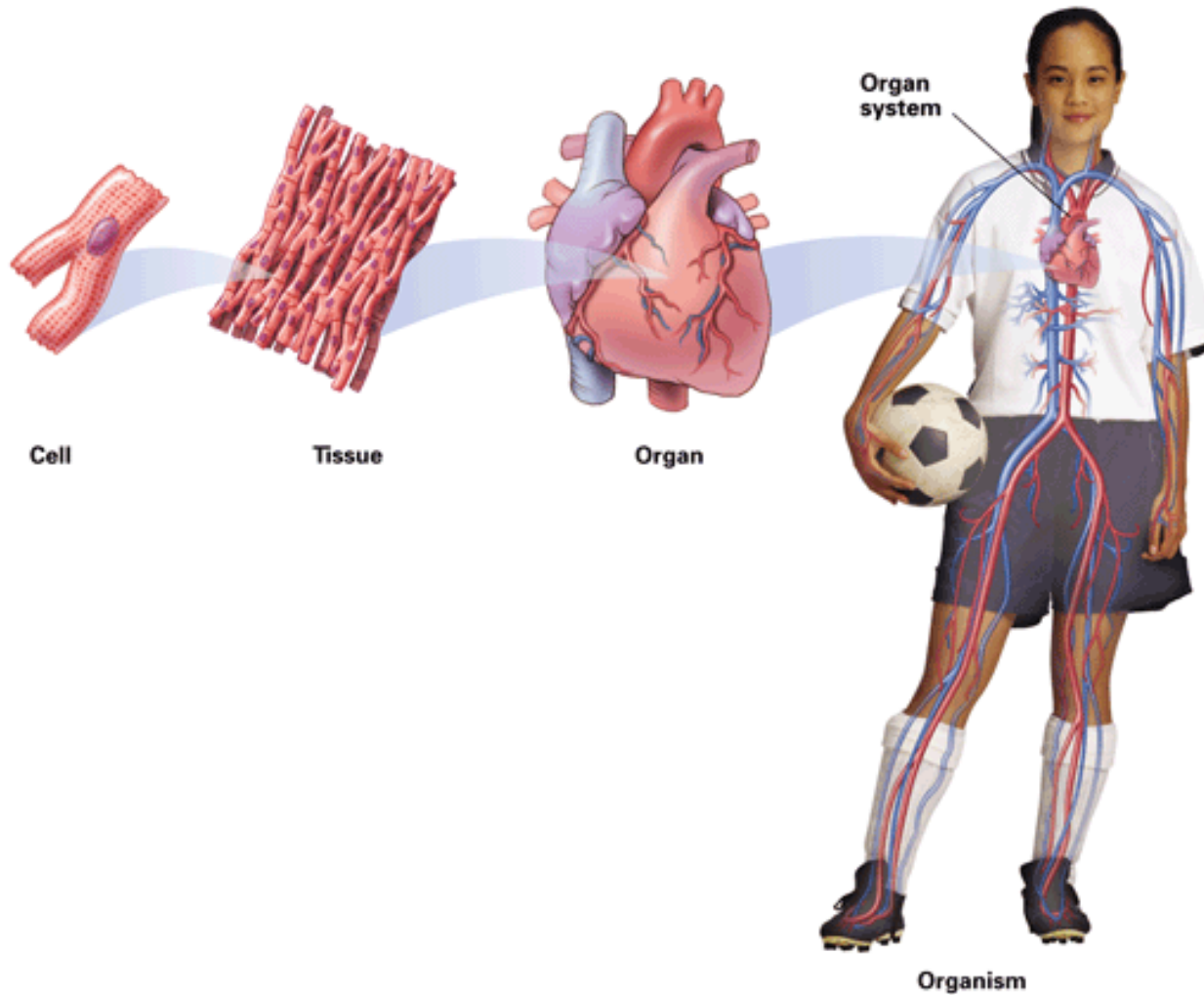
Organism

- Different organ systems working together

Digestive system



Human circulatory system



Organ system examples

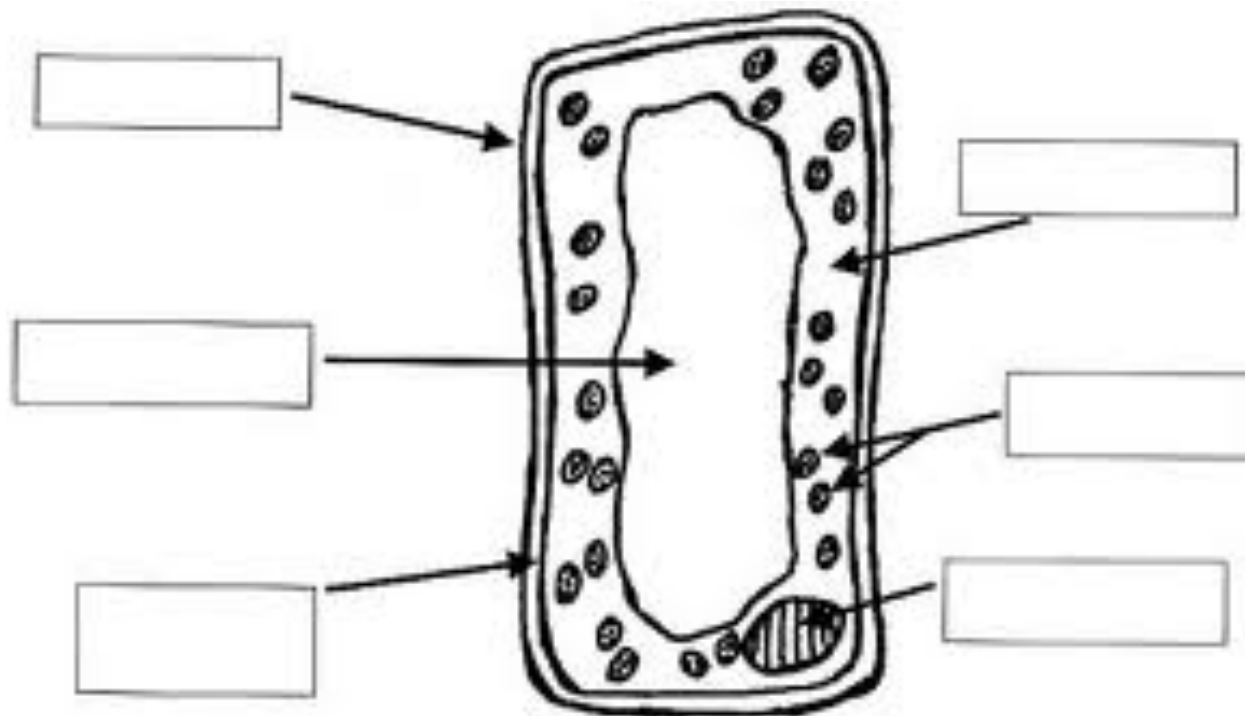
system	composite
digestive	Gullet, stomach, pancreas, liver, intestines
excretory	Kidney, ureters, bladder
nervous	Brain spinal cord, nerves

Questions

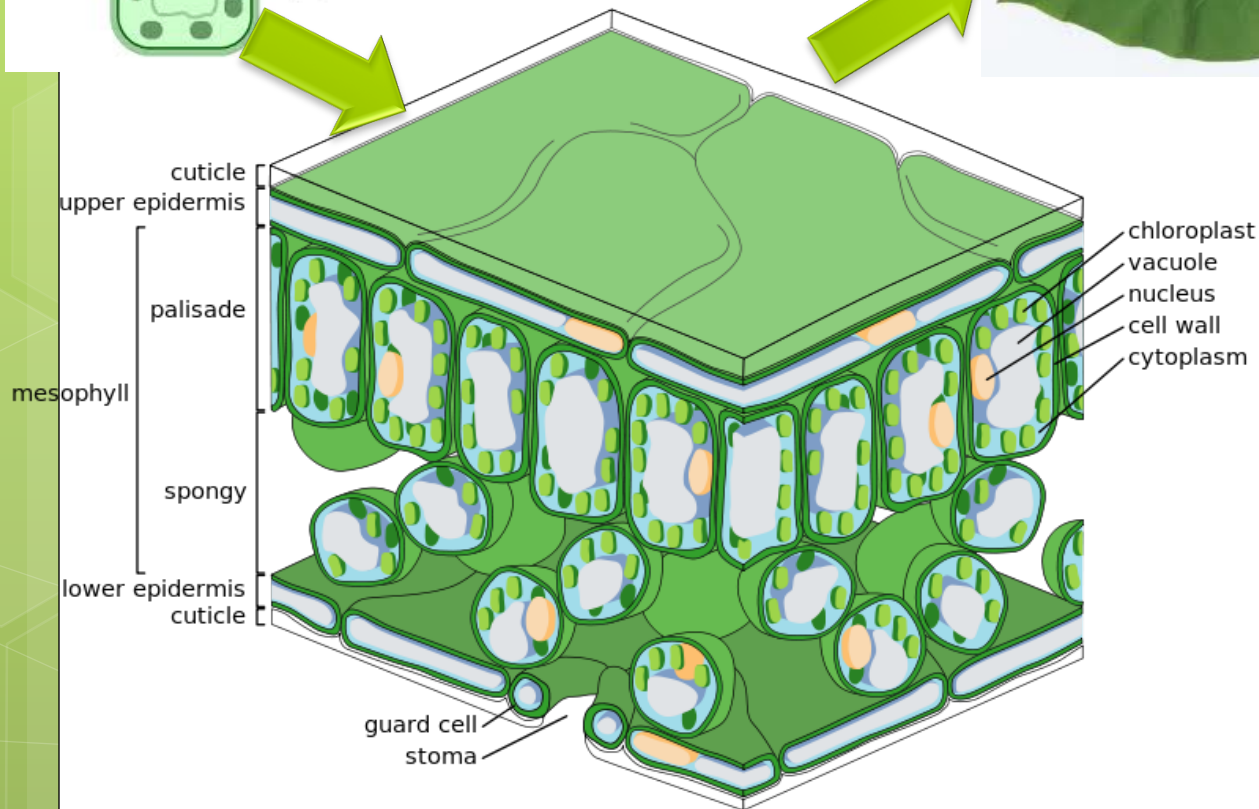
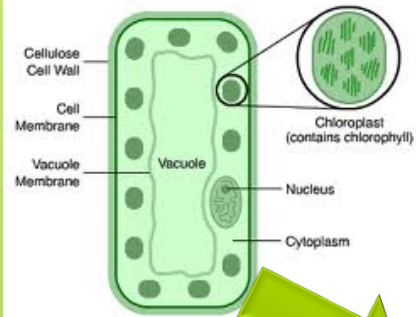
- Page 23 Questions 1-3

Plants level of organization

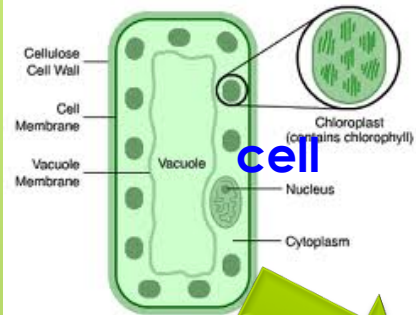
- Label the plant cell



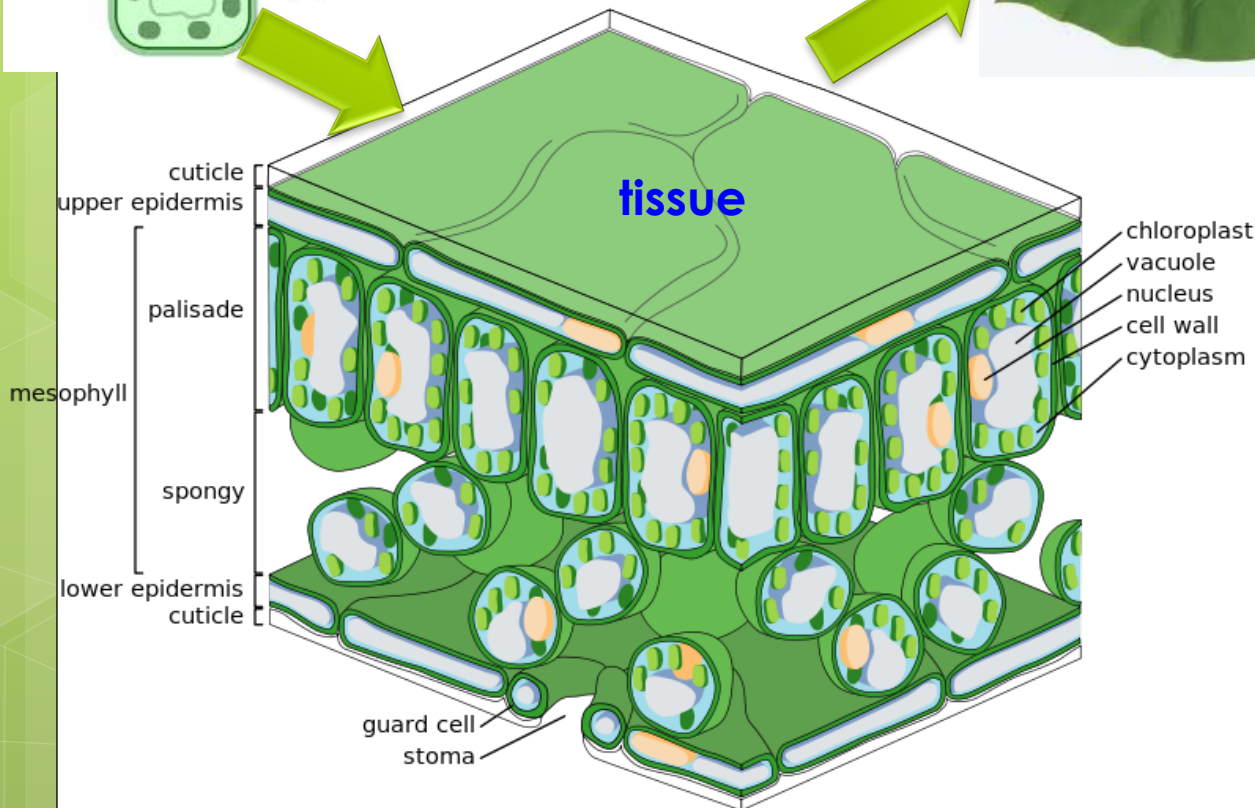
Plants level of organization



Plants level of organization



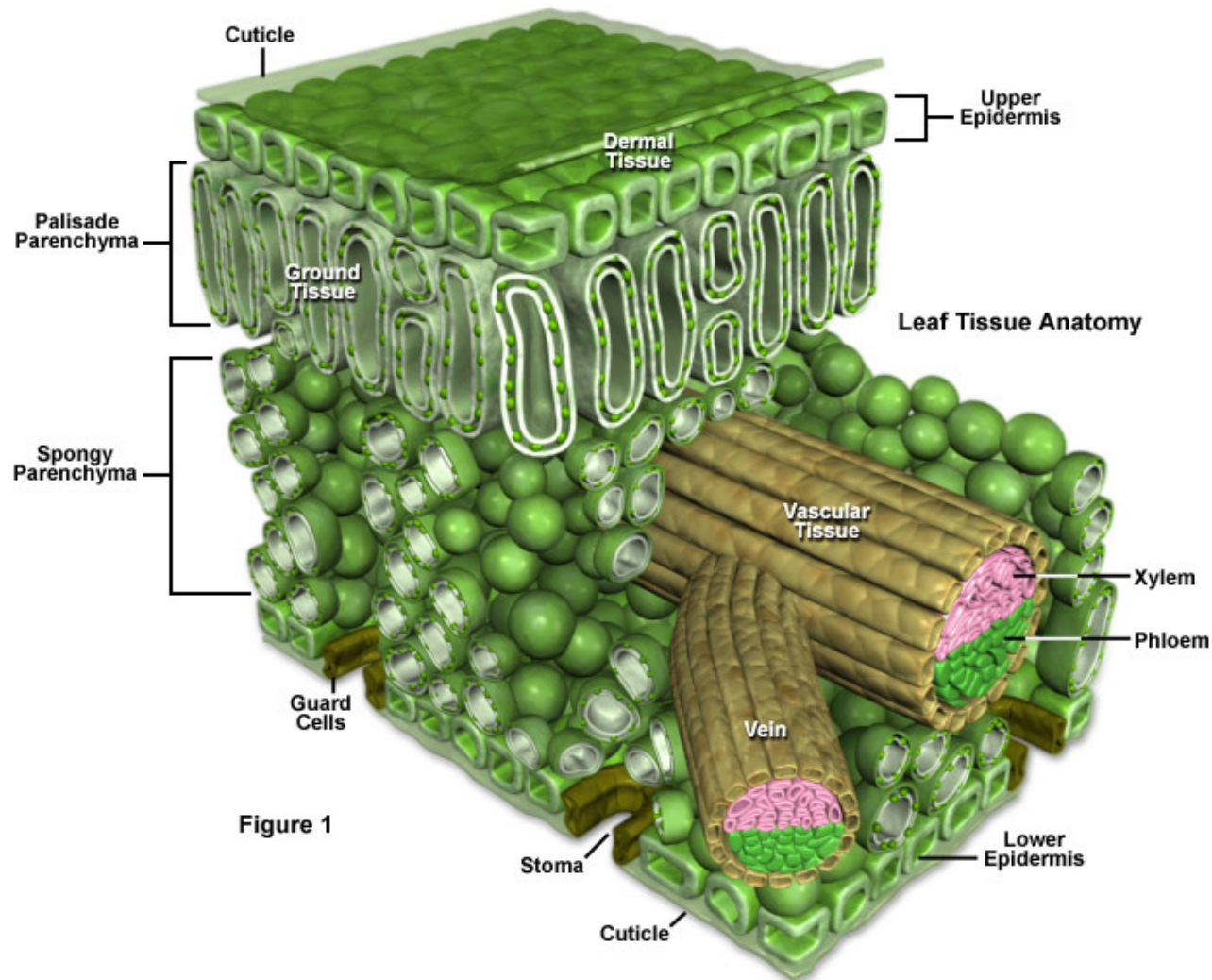
cell



tissue



Plants level of organization



Plants level of organization

cell

- Palisade cells
- Packed with chloroplasts
- Absorb lots of light

tissue

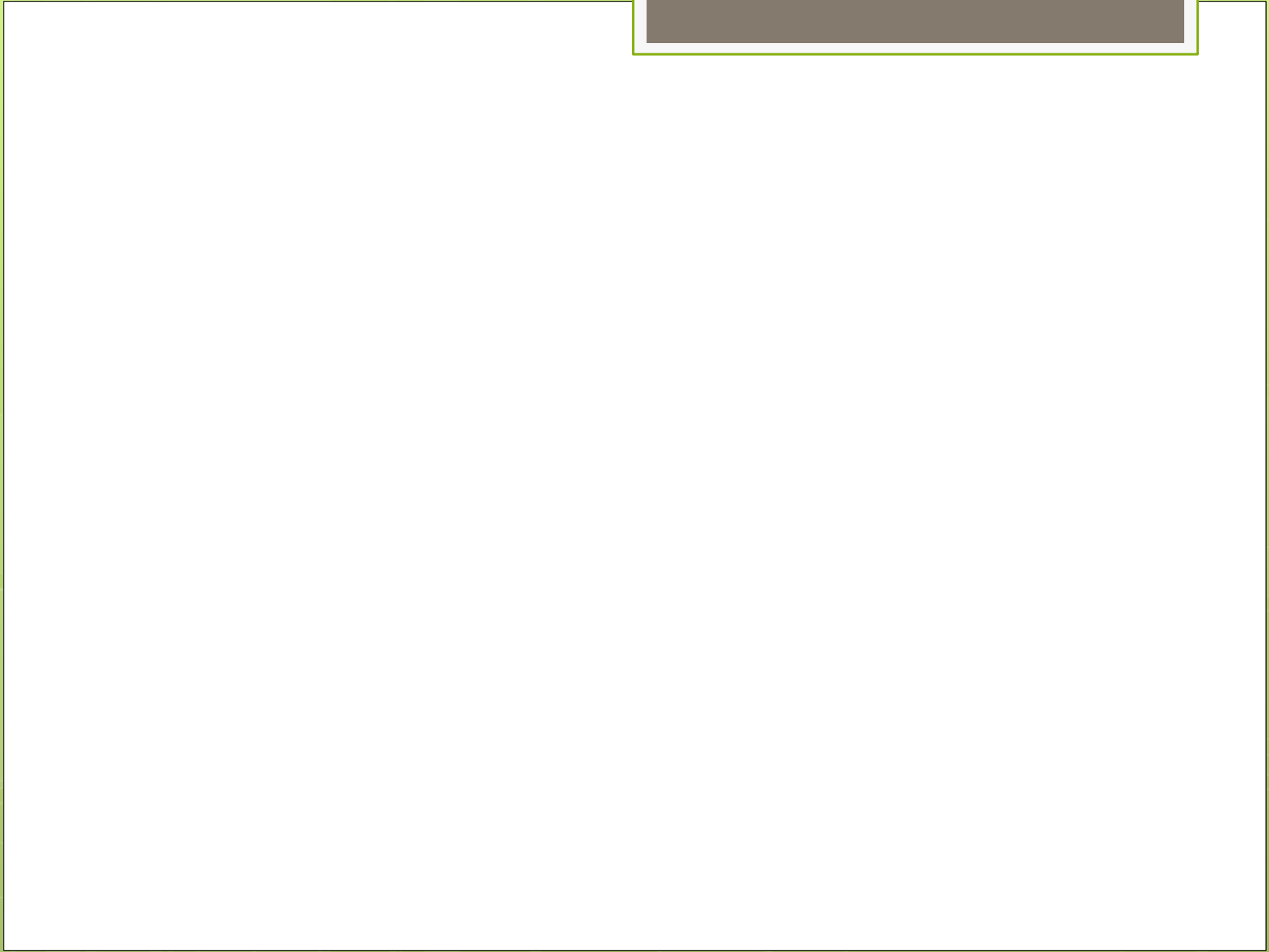
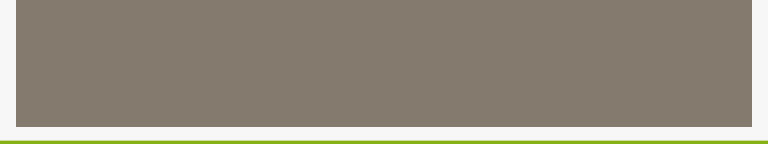
- similar cells working together in the same way
- Carries out photosynthesis (Palisade + spongy mesophyll cells)
- Palisade more chloroplast → more photosynthesis

organ

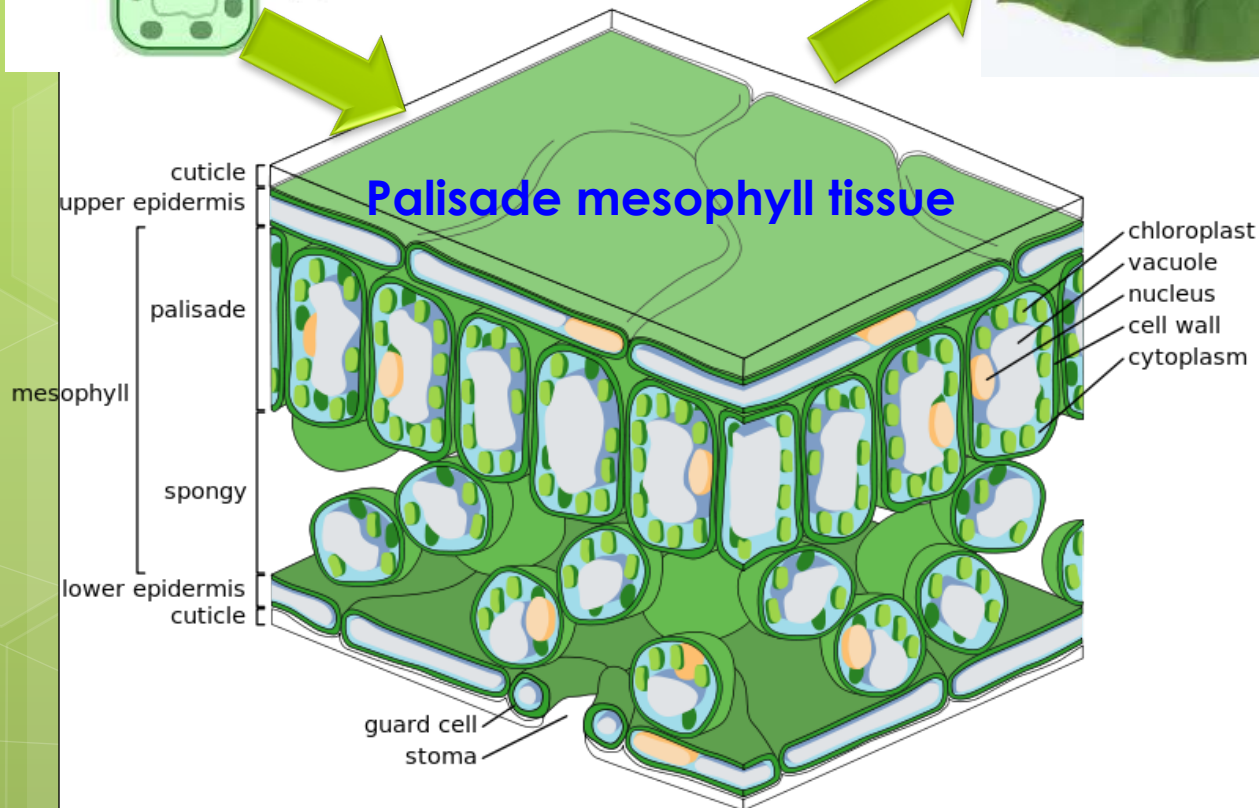
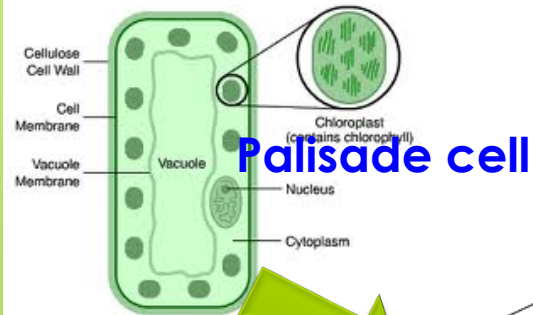
- Group of tissues working together
- Leaf makes food and allows gas exchange
- Other organs: roots, stems

Organism

- Made up of organs



Plants level of organization





Movement in and out of cell

Topic 2 – chapter 3

Diffusion

- What is diffusion? Can you give me an example?

Diffusion

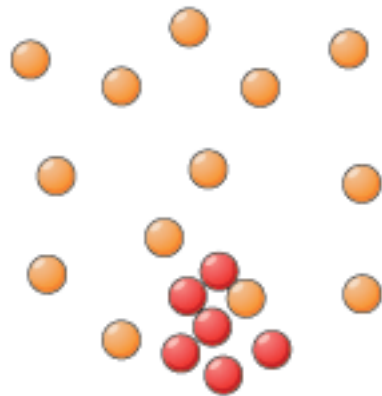
- Does it happen only in gases? Does it happen in liquids? Any difference between them?
- Simulation

Diffusion

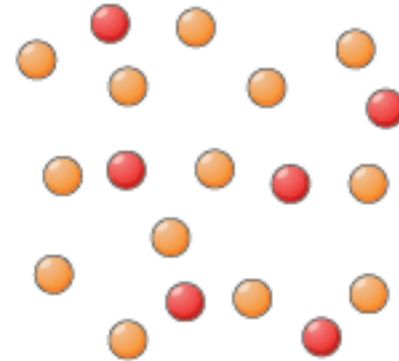
- Definition: it is the net movement of particles of a gas or liquid from an area of HIGH concentration to an area of LOW concentration as a result of the random movement of molecules.

Diffusion

- Diffusion in a gas



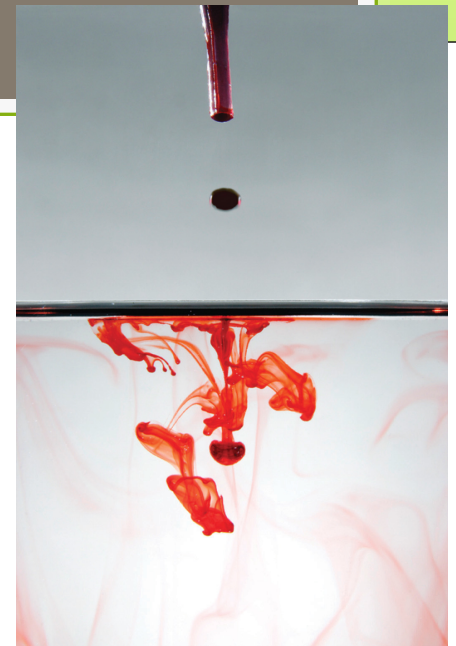
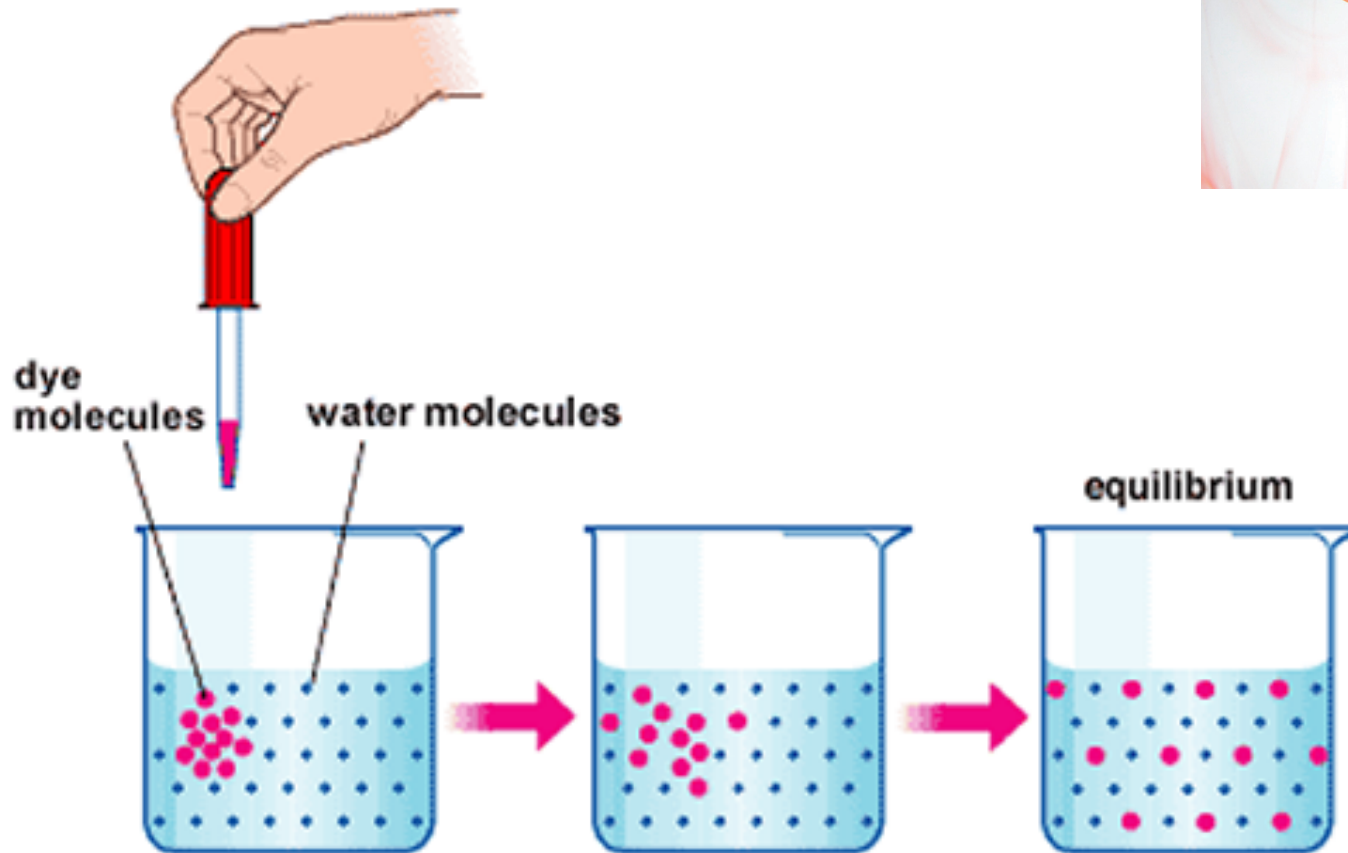
Before diffusion



After diffusion

Diffusion

- Diffusion in a liquid

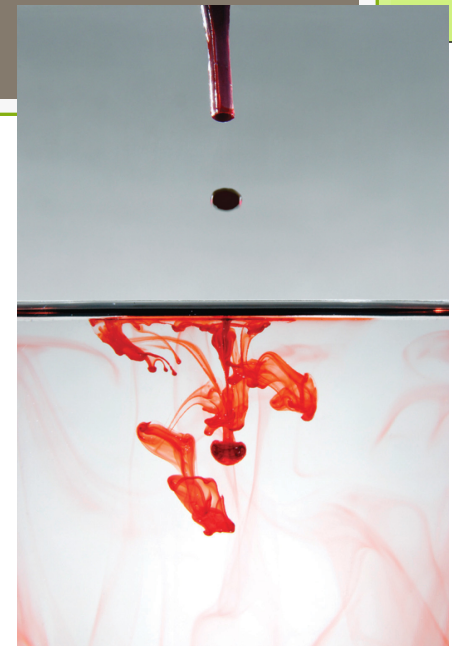
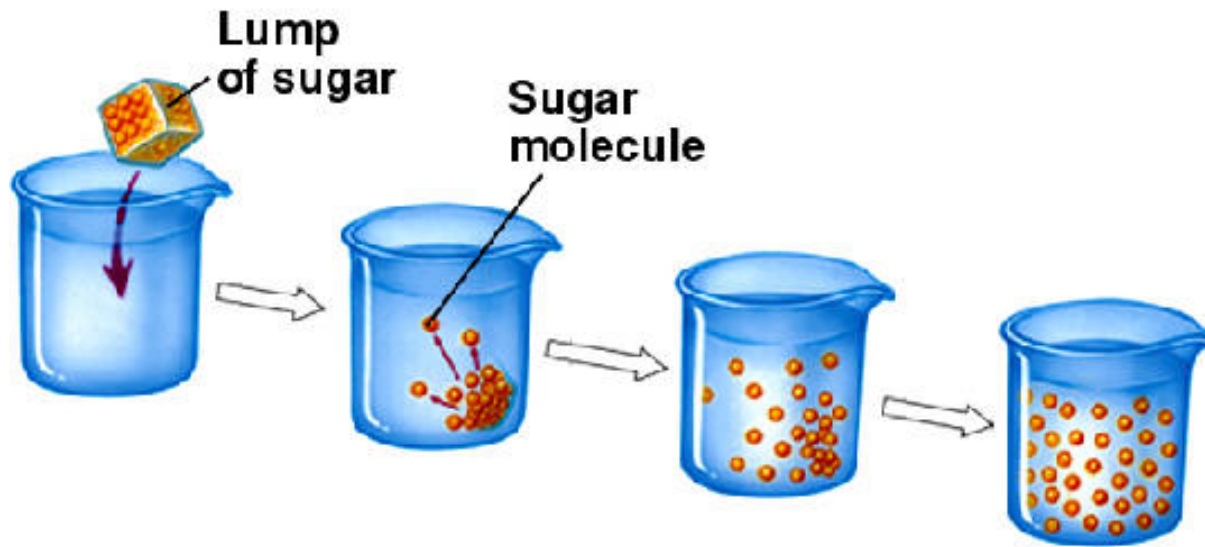


Diffusion

- Diffusion in a liquid

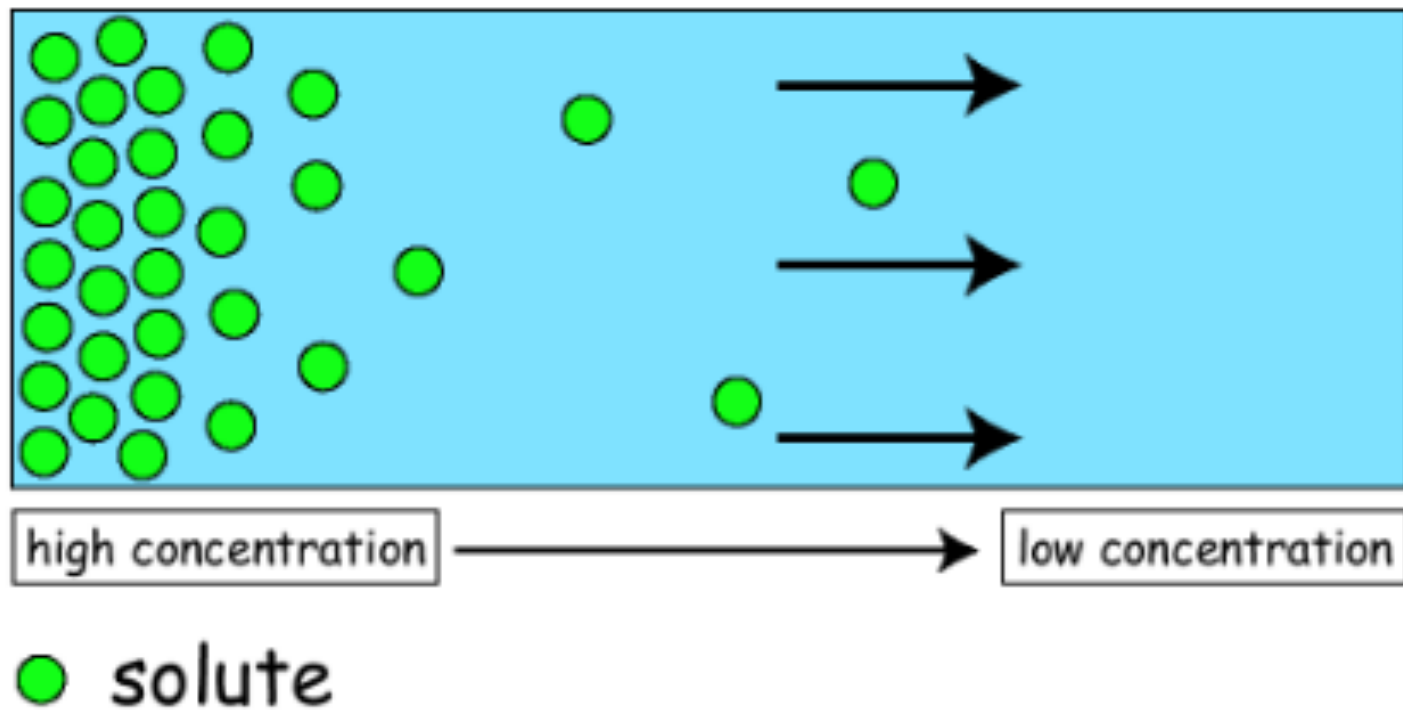
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Diffusion



Diffusion

Diffusion



Diffusion

- Movement in gas faster than liquid because molecules are more spread out
- Molecules spread from where they are lots (high concentration) to places where there is little (low concentration)
- Difference between concentrations in these two place is called **concentration gradient**.
- Molecules carry on diffusion until spread out evenly

Diffusion

- Updated definition: it is the net movement of particles of a gas or liquid from an area of HIGH concentration to an area of LOW concentration **down a concentration gradient**.
- Why do cells need diffusion?

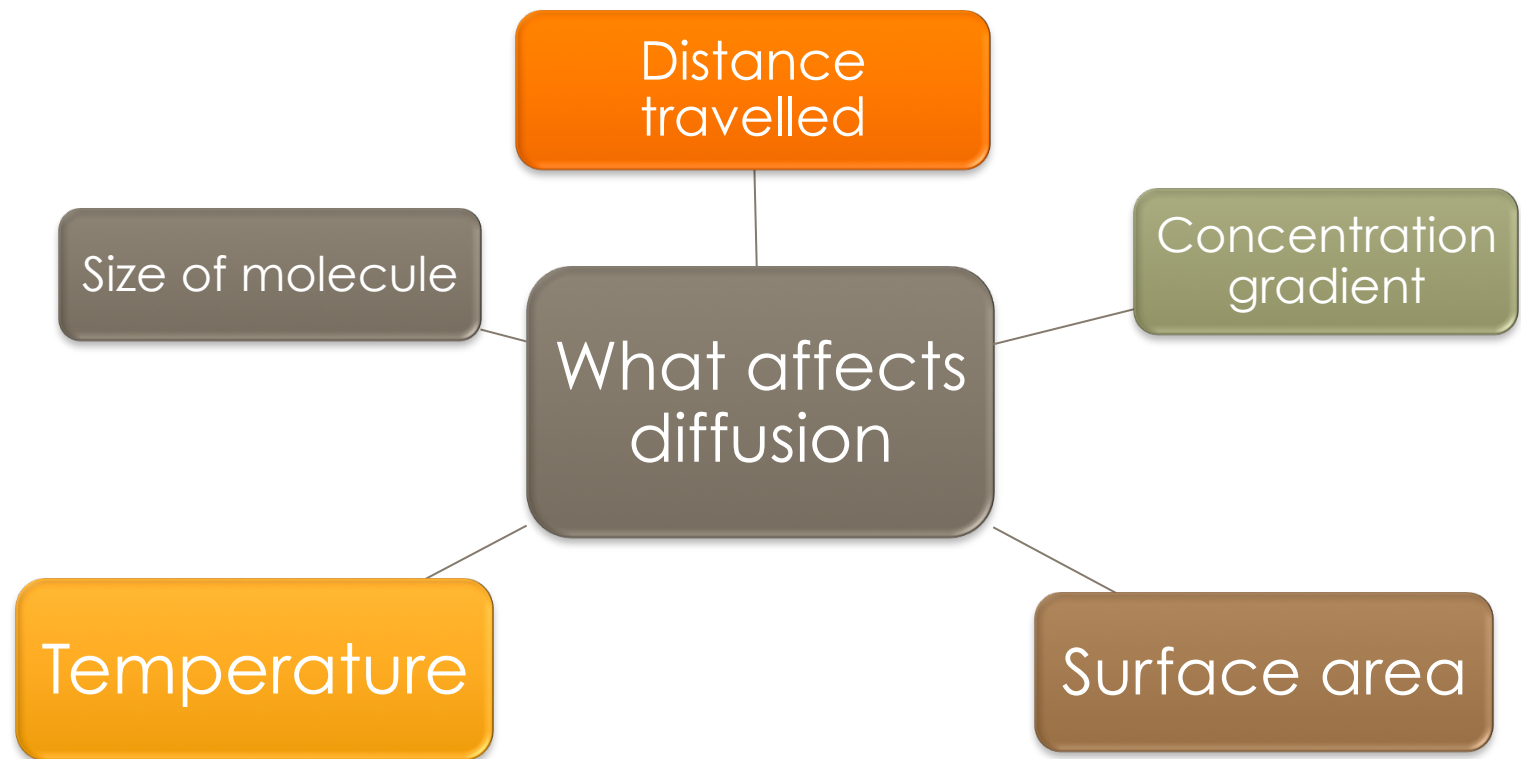
Diffusion

- Why do cells need diffusion?
 - Gain substances from surrounding
 - Lose their waste to surroundings
- What do they have to pass through in order to obtain or get rid of substances?

Diffusion

- Why do cells need diffusion?
 - Gain substances from surrounding
 - Lose their waste to surroundings
- What do they have to pass through in order to obtain or get rid of substances?
 - Cell membrane (partially permeable)
 - Easy passage: oxygen, carbon dioxide, water
- Movement of particles across cell membrane is called passive movement (no use of energy that's why its called passive)

Factors that affect diffusion



Factors that affect diffusion

- Explanations for some:
 - Concentration gradient: use substances diffused so they still have a low concentration inside cytoplasm
 - Surface area: some cells have folded membranes to give more surface for diffusion
 - Temperature: higher temperature particles collide faster therefore faster diffusion
 - Size of molecules: smaller easier to diffuse.

Gas VS liquid

- ◉ Diffusion through air 300,000 times faster than water
- ◉ Gas exchange in
 - ◉ Animals:
 - ◉ Mammals: in alveoli in lungs (large surface area)
 - ◉ Oxygen diffuses in.. Carbon dioxide out on other side
 - ◉ Breathing refreshes air in alveoli
 - ◉ Concentration gradient – high
 - ◉ Plants
 - ◉ Stomata: opening in spongy mesophyll cells in the leaf
 - ◉ Large surface area

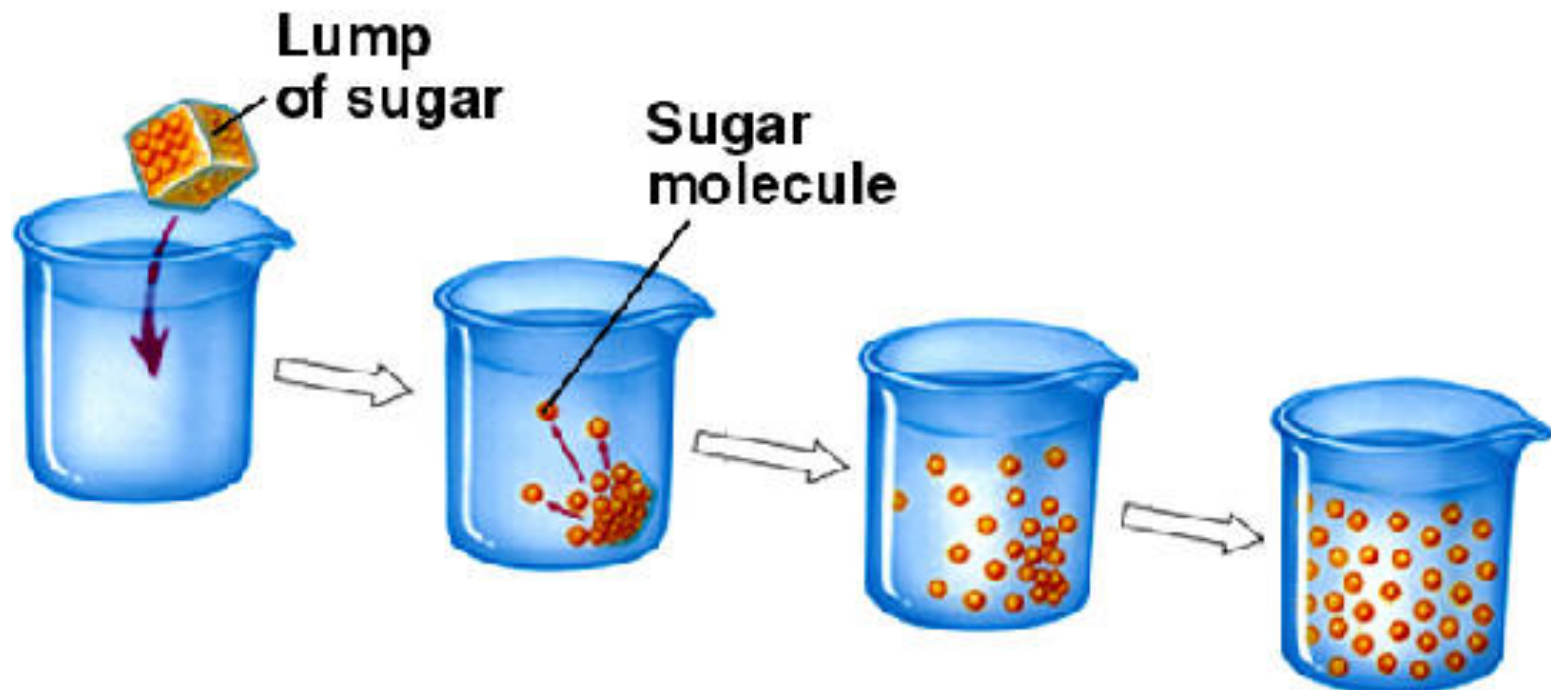
Solute VS solvent

- Water and sugar... which is the solute and which is the solvent?

Solute VS solvent

- A solution is made from solute + solvent
- Solute dissolves in solvent
- E.g.: sugar – solute Water – solvent
.... You form a sugar solution
- Liquids and gases can be solvents
- When something is dissolved it is described as soluble.
- Water – universal solvent
- Cytoplasm (75% water)

Diffusion



Questions

- Page 27 (1 – 4)

OSMOSIS

- What allows substances in and out of cell?

OSMOSIS

- What allows substances in and out of cell?
- Can all substances travel across the cell membrane? What limits their travel?

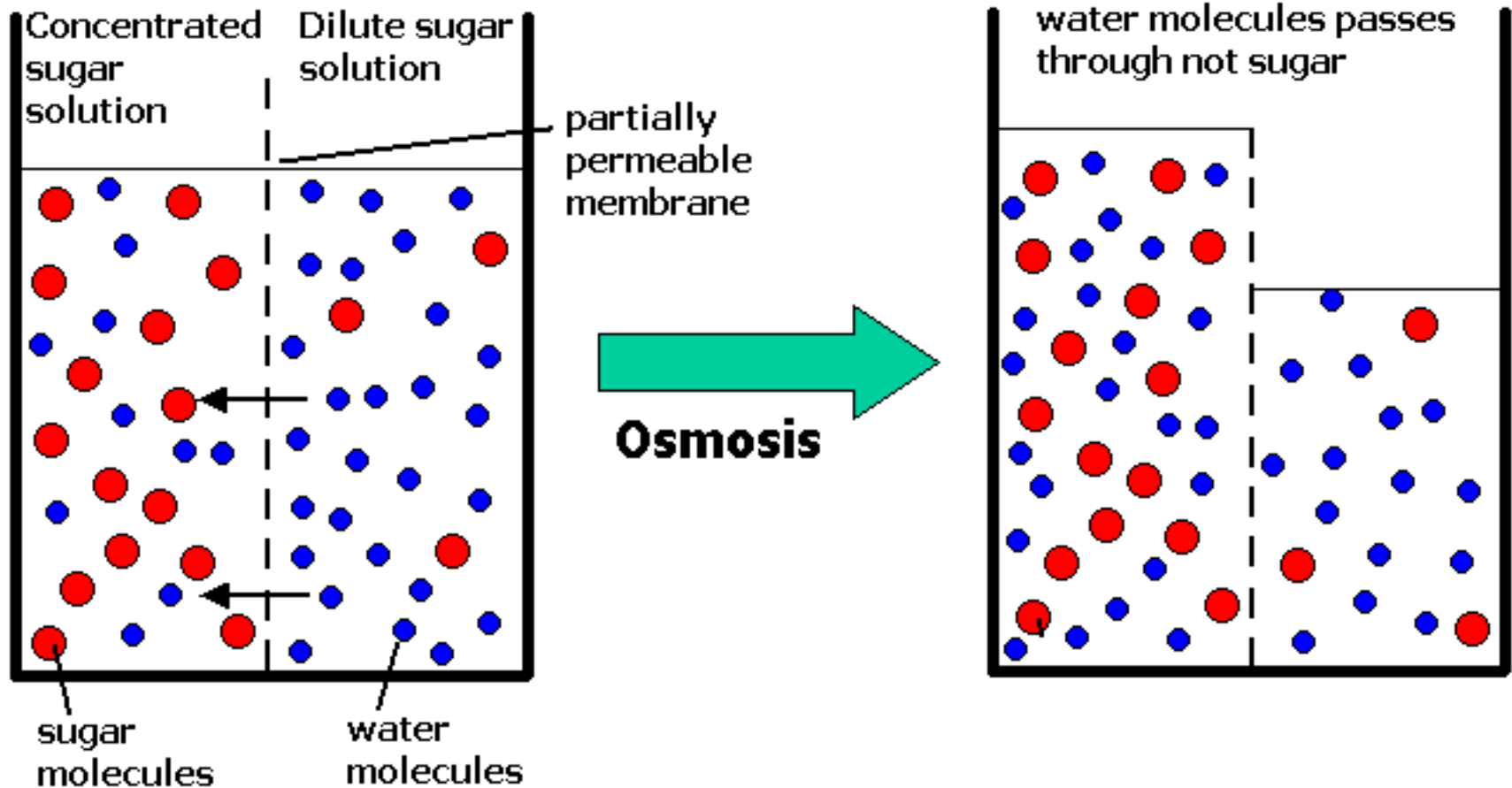
OSMOSIS

- Can all substances travel across the cell membrane? What limits their travel?
- NO... size and the nature of the particles... if its too big or polar it not be able to pass through the cell membrane
- Membrane has tiny holes water will travel through
- Large molecules cant pass through these holes
- To solve this problem and to balance the concentrations, water will travel across the membrane

OSMOSIS

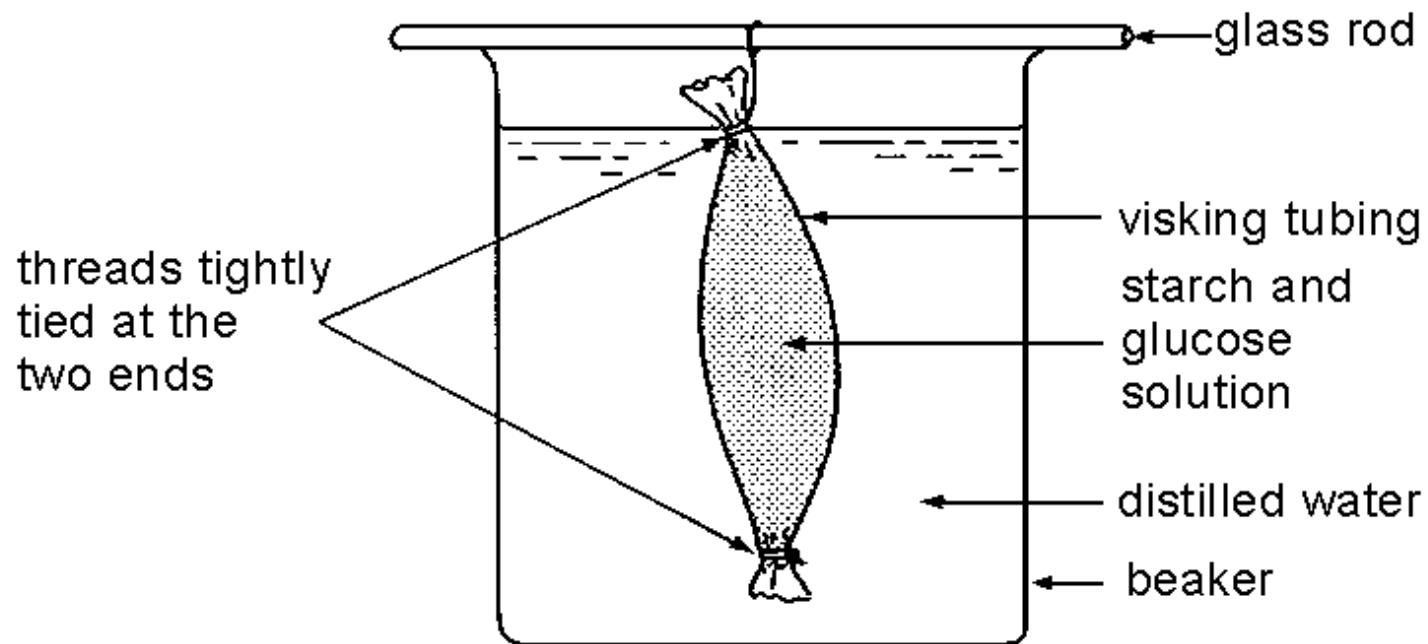
- Osmosis special kind of diffusion
- Water molecules separated by a partially permeable membrane
- **Definition: it is the diffusion of water molecules from a high concentration of water to a low concentration of water through a partially permeable membrane.**

OSMOSIS



OSMOSIS

- Dialysis tubing (Visking tubing) – partially permeable membrane



Apparatus to show dialysis

Questions

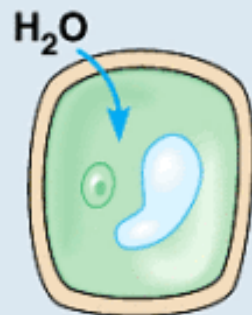
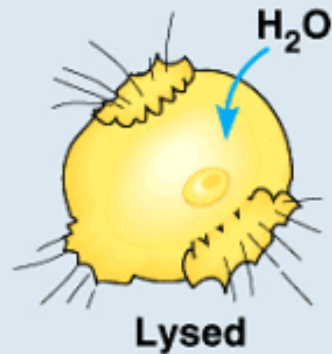
- Page 29 1+2

Osmosis in plants VS animals

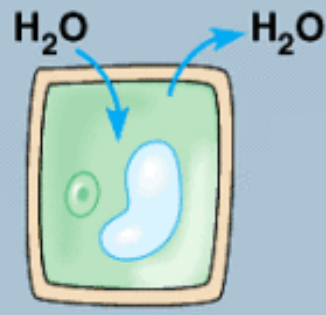
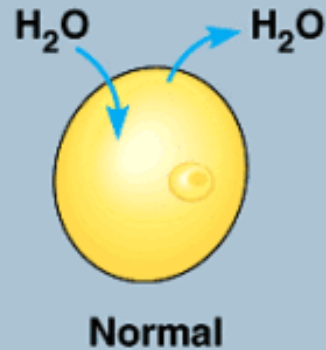
- Any differences/similarities in what might happen to the cells during osmosis in both animals and plants?

Osmosis in plants VS animals

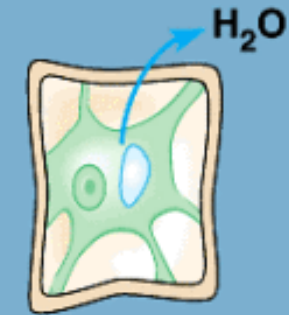
Hypotonic solution



Isotonic solution



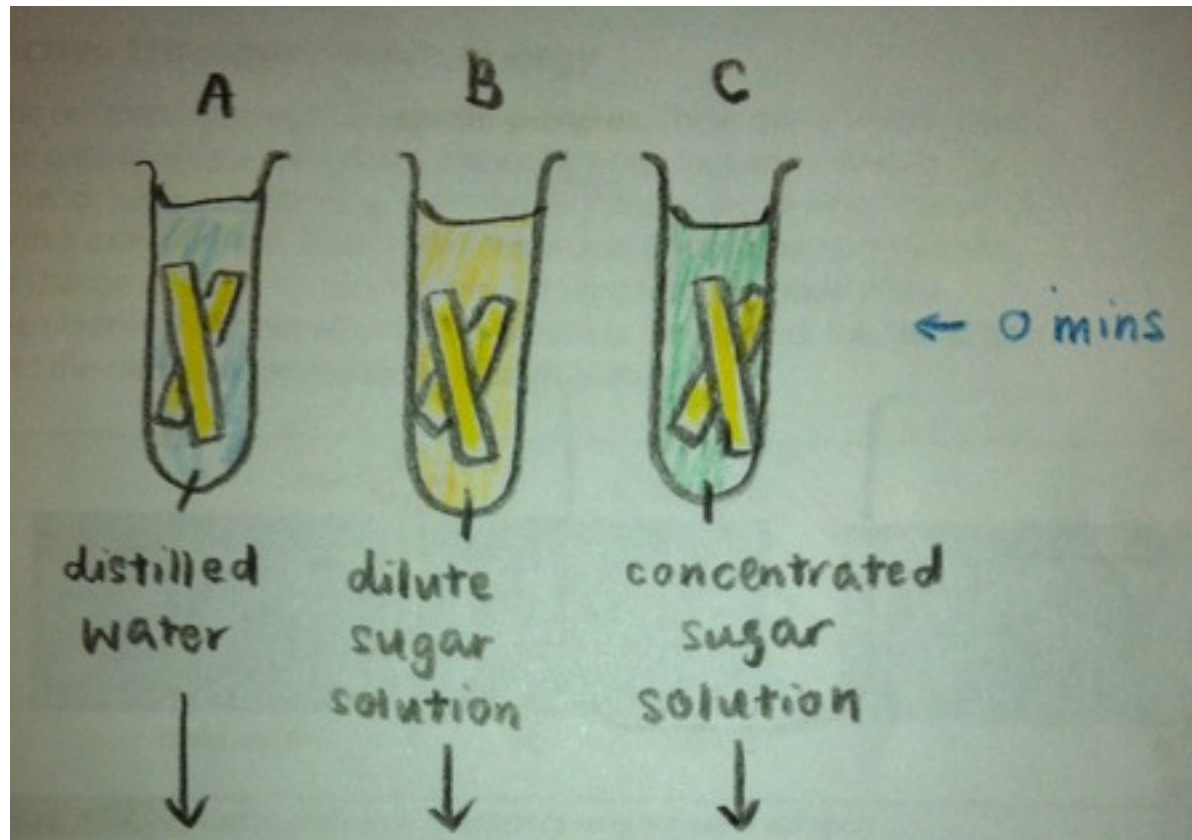
Hypertonic solution



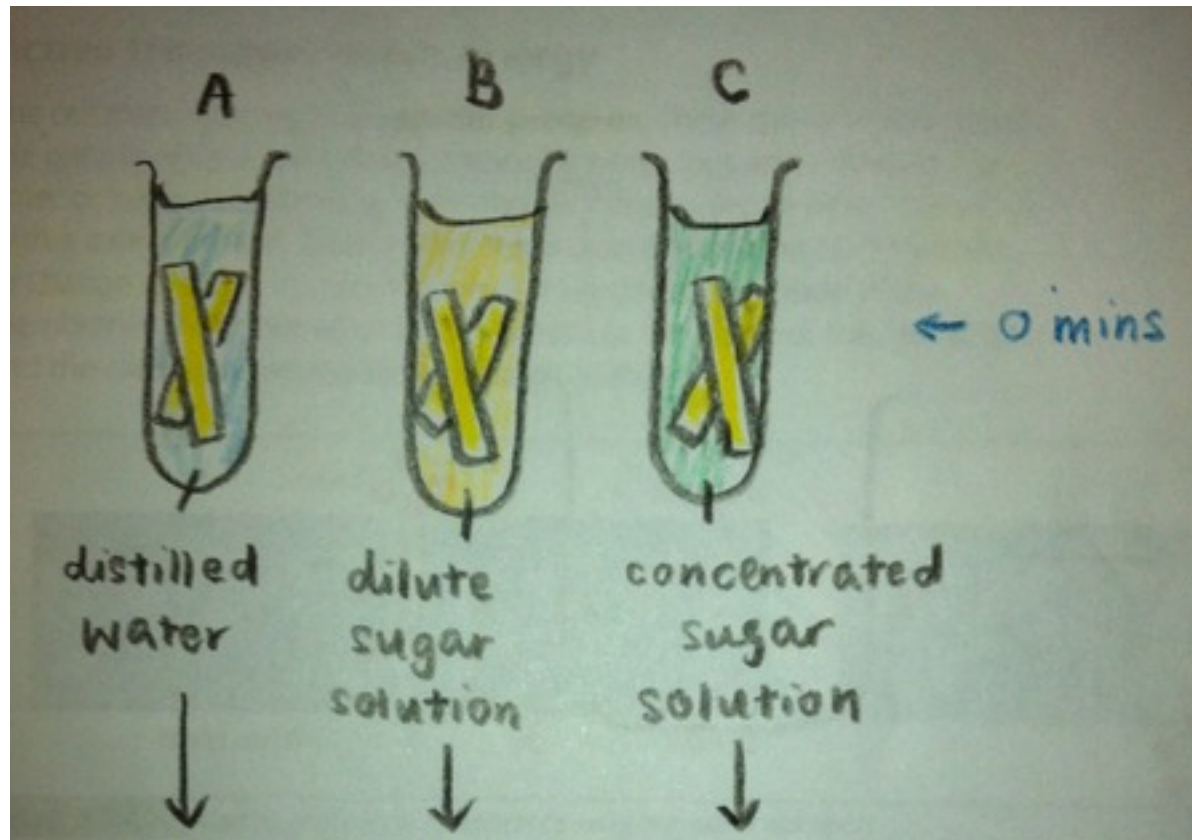
Animal cell

Plant cell

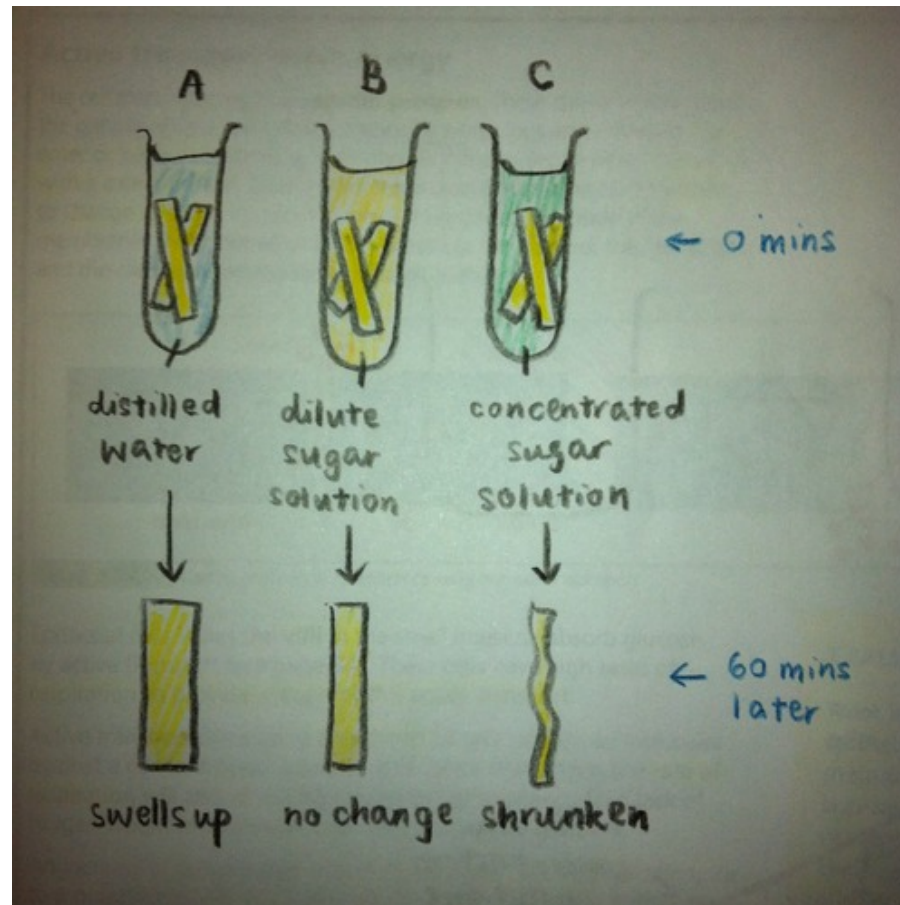
Osmosis in plants



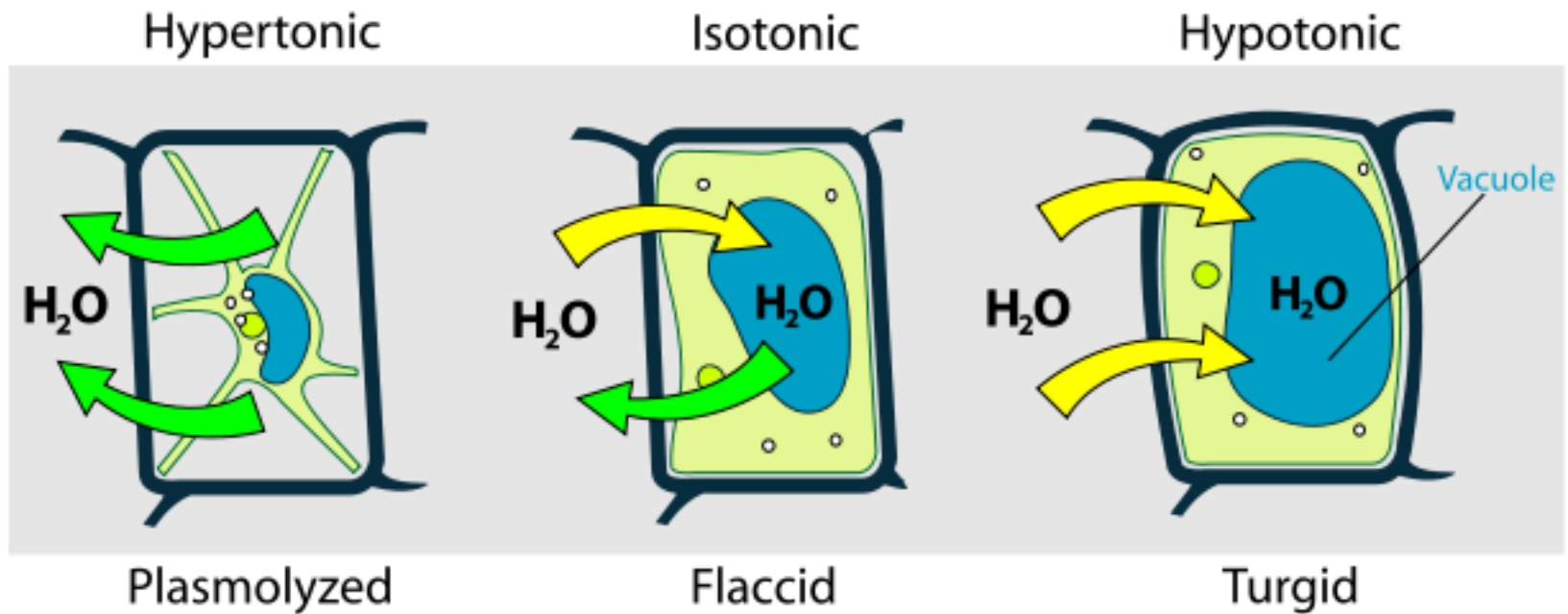
Osmosis in plants



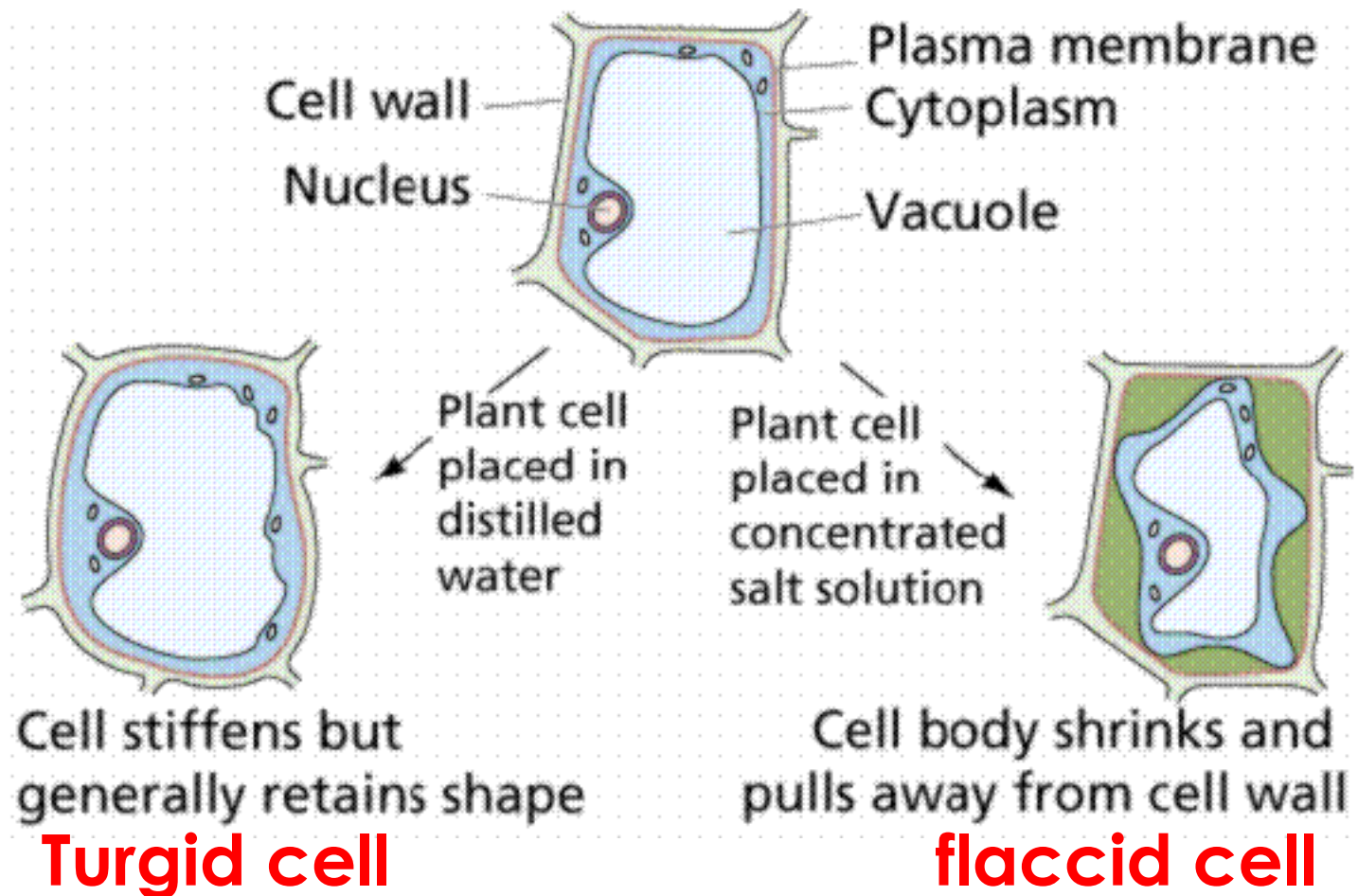
Osmosis in plants



Osmosis in plants



Osmosis in plants



Osmosis in plants

- Water moves into/out off cell
- Water enters cell when?

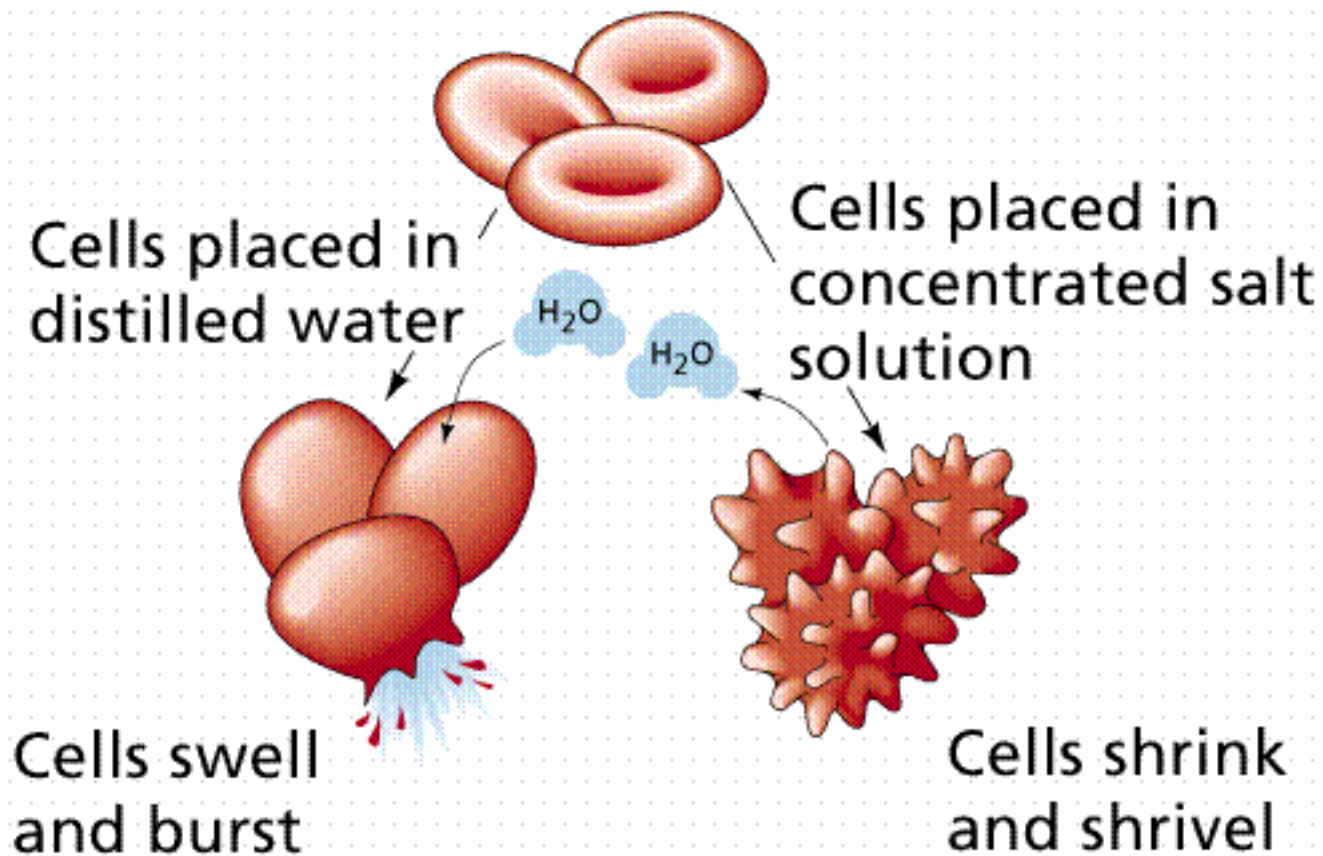
Osmosis in plants

- Water moves into/out off cell
- Water IN:
 - Water enters cell when there is less water
 - Cell will balloon up and push against cell wall
 - cell wall protects it from bursting
 - Cell is TURGID
 - Turgid cells give plants support for young leaves and stems (keeps them upright)

Osmosis in plants

- Water moves into/out off cell
- Water OUT:
 - Water leaves cell when water out is less
 - Cell shrink (wilt/ limp)
 - No longer firm
 - We call them flaccid
 - When cell membrane moves away from cell wall we say the cell are plasmolysed

Osmosis in animals



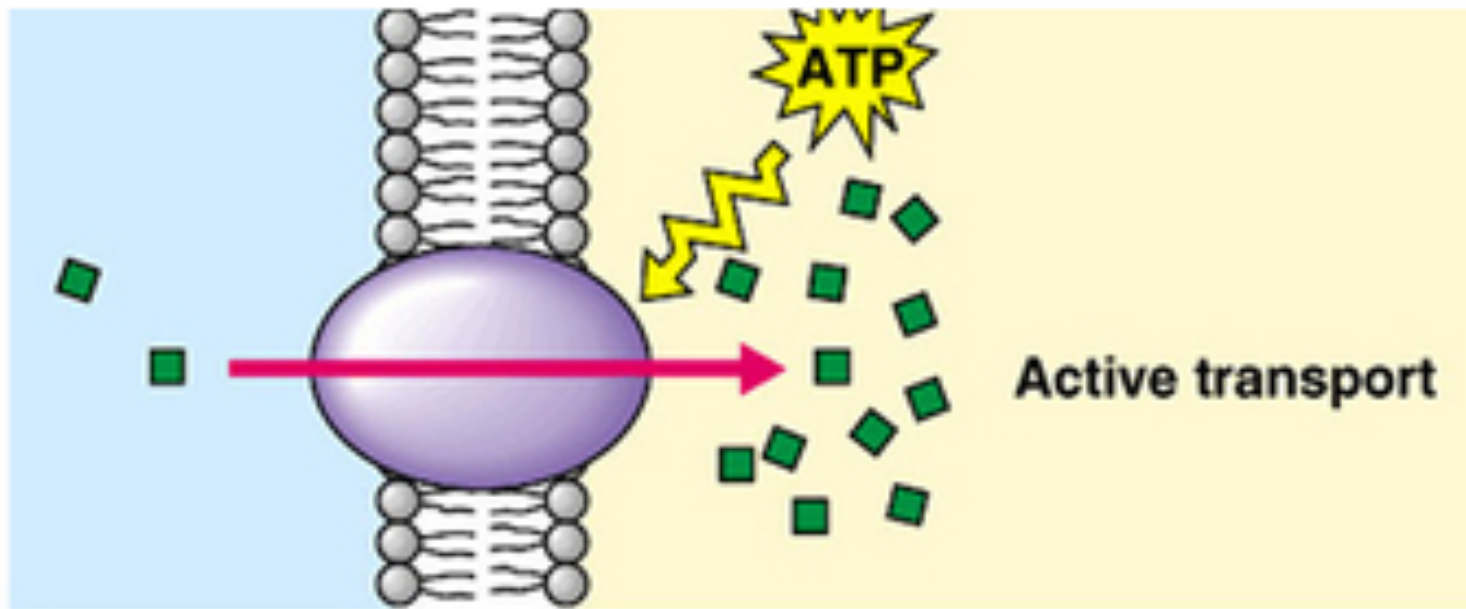
Questions

- Page 31 1+2

Active transport

- Sometimes substances are required to be moved **against** the **Concentration Gradient**, or faster than they would by Passive Transport.
- In these cases, **Active Processes** are used, which require **energy**.

Active transport



Active transport

- There are many occasions when cells need to take in **substances** which are only present in **small quantities** around them.
- E.g. **root hair** cells in plants take in **nitrate** ions *from the soil*. Their concentration are often higher inside the root hair cell than in the soil, so the **diffusion gradient** is from the *root hair* to the *soil*. Despite this, the root hair cells still can take nitrate ions in, by **active transport**.

Active transport

- In humans, active transport takes place during the **digestion** of food in the small intestine.
- Carbohydrates are broken down into simple sugars such as glucose.
- The glucose is absorbed by active transport into the villi, to be passed into the bloodstream and taken around the body.

Active transport

- Definition: movement of ions from a region of their **lower** concentration to a region of their **higher** concentration **against** a **concentration gradient** using **energy**.

Active transport

- This **active transport**
 - requires **energy** as **ATP** from respiration to 'drive' the molecules 'uphill'
 - is affected by factors affecting **respiration** (temperature, oxygen concentration)

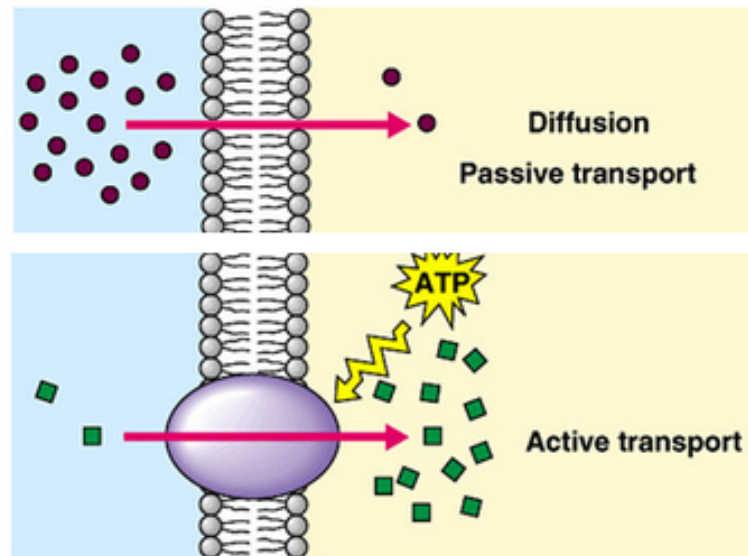
Site	Substance	Direction
Root hair cells	Mineral salts (phosphate...)	Soil → roots
Wall of small intestine (villi)	Glucose	Small intestine → blood plasma

Active transport VS Diffusion

- ???

Active transport VS Diffusion

- **direction** of movement (**down** or **up** a gradient)
- use of **energy** for movement



Question

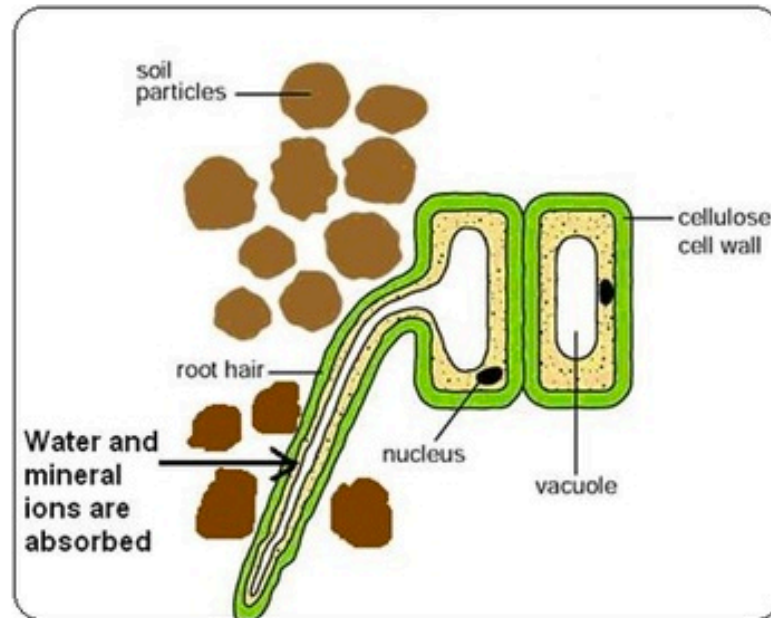


Figure above shows root hair cells.

1. Explain how the presence of root hair cells on roots enables the efficient absorption of water and minerals. [2 marks]
2. Root hair cells can absorb mineral ions by diffusion and active transport.
 - a) Define the term active transport [2 marks]
 - b) Explain why respiration rates may increase in root hair cells during the uptake of mineral ions [1 mark]

Question

1. - Large number of root hair cells give a large surface area to the root.

- Mitochondria are present to provide energy for active transport.

2. a) active transport is absorption of a substance into a cell or across a membrane

- against (up) a concentration gradient.
- using energy

b) active transport requires energy